

Claims

1 1. An apparatus for taking absorbance-based chemical measurements comprising a
 2 reagent-based optical chemical sensor comprising an analyte-selective reagent, means for
 3 renewing said reagent, means for allowing said reagent to reach equilibrium with an analyte
 4 and, means for calculating the sensor response from a ratio of the absorbance of said reagent
 5 determined relative to a blank solution.

1 2. The apparatus of claim 1, wherein said analyte-selective reagent is colorimetric.

1 3. The apparatus of claim 1, wherein said analyte-selective reagent is fluorescent.

1 4. The apparatus of claim 1, wherein said means for renewing said reagent comprises
 2 a pump and at least one valve.

1 5. The apparatus of claim 1, wherein said means for renewing said reagent is selected
 2 from a group consisting of at least one peristaltic pump, at least one syringe pump, at least
 3 one positive displacement pump, at least one solenoid pump and valve and at least one pinch
 4 valve.

1 6. The apparatus of claim 1, wherein said means for renewing said reagent comprises
 2 a solenoid pump and valve.

1 7. The apparatus of claim 1, wherein said means for calculating the sensor response
 2 includes the equation $A_R = A_{\lambda 1} / A_{\lambda 2}$, where A_R is said sensor response, $A_{\lambda 1}$ is absorbance at $\lambda 1$
 3 and $A_{\lambda 2}$ is absorbance at $\lambda 2$ and, wherein $A_{\lambda 1}$ and $A_{\lambda 2}$ are determined by

$$A_{\lambda} = -\log \frac{I_{\lambda}}{I_{\lambda 0}}$$

1 8. The apparatus of claim 1, wherein said reagent-based optical chemical sensor is a
2 Submersible Autonomous Moored Instrument for CO₂.

1 9. The apparatus of claim 8, wherein said analyte-selective reagent is bromothymol
2 blue.

1 10. The apparatus of claim 8, wherein said Submersible Autonomous Moored
2 Instrument for CO₂ comprises a spectrograph filter.

1 11. The apparatus of claim 8, wherein said Submersible Autonomous Moored
2 Instrument for CO₂ comprises a GaP photodiode.

1 12. The apparatus of claim 8, wherein said means for calculating the sensor response
2 includes the equation $A_R = A_{\lambda 1} / A_{\lambda 2}$, where A_R is said sensor response, $A_{\lambda 1}$ is absorbance at $\lambda 1$
3 and $A_{\lambda 2}$ is absorbance at $\lambda 2$ and, wherein $A_{\lambda 1}$ and $A_{\lambda 2}$ are determined by

$$A_{\lambda} = -\log \frac{I_{\lambda}}{I_{\lambda 0}}$$

1 13. A method of taking absorbance-based chemical measurements comprising the
2 steps of:

- 3 a) utilizing a reagent-based optical chemical sensor comprising an analyte-
4 selective reagent;
- 5 b) renewing said analyte-selective reagent;
- 6 c) equilibrating said renewed analyte-selective reagent to said analyte; and
- 7 d) calculating the sensor response from a ratio of the absorbance of said analyte-
8 selective reagent determined relative to a blank solution.

1 14. The method of claim 13, wherein said analyte-selective reagent is colorimetric.

1 15. The method of claim 13, wherein said analyte-selective reagent is fluorescent.

1 16. The method of claim 13, wherein said reagent is renewed by a pump and at least
2 one valve.

1 17. The method of claim 16, wherein said pump and at least one valve are selected
2 from a group consisting of at least one peristaltic pump, at least one syringe pump, at least
3 one positive displacement pump, at least one solenoid pump and valve and at least one pinch
4 valve.

1 18. The method of claim 13, wherein said reagent is renewed by a solenoid pump and
2 valve.

1 19. The method of claim 13, wherein said sensor response is calculated using the
2 equation $A_R = A_{\lambda 1} / A_{\lambda 2}$, where A_R is said sensor response, $A_{\lambda 1}$ is absorbance at $\lambda 1$ and $A_{\lambda 2}$ is
3 absorbance at $\lambda 2$ and, wherein $A_{\lambda 1}$ and $A_{\lambda 2}$ are determined by

$$A_{\lambda} = -\log \frac{I_{\lambda}}{I_{\lambda 0}}$$

1 20. The method of claim 13, wherein said reagent-based optical chemical sensor is
2 a Submersible Autonomous Moored Instrument for CO₂.

1 21. The method of claim 20, wherein said analyte-selective reagent is bromothymol
2 blue.

1 22. The method of claim 20, wherein said Submersible Autonomous Moored
2 Instrument for CO₂ comprises a spectrograph filter.

Parameter	1990-1991		1991-1992		1992-1993		1993-1994		1994-1995		1995-1996		1996-1997		1997-1998		1998-1999		1999-2000		2000-2001		2001-2002		2002-2003		2003-2004		2004-2005		2005-2006		2006-2007		2007-2008		2008-2009		2009-2010		2010-2011		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2028-2029		2029-2030		2030-2031		2031-2032		2032-2033		2033-2034		2034-2035		2035-2036		2036-2037		2037-2038		2038-2039		2039-2040		2040-2041		2041-2042		2042-2043		2043-2044		2044-2045		2045-2046		2046-2047		2047-2048		2048-2049		2049-2050		2050-2051		2051-2052		2052-2053		2053-2054		2054-2055		2055-2056		2056-2057		2057-2058		2058-2059		2059-2060		2060-2061		2061-2062		2062-2063		2063-2064		2064-2065		2065-2066		2066-2067		2067-2068		2068-2069		2069-2070		2070-2071		2071-2072		2072-2073		2073-2074		2074-2075		2075-2076		2076-2077		2077-2078		2078-2079		2079-2080		2080-2081		2081-2082		2082-2083		2083-2084		2084-2085		2085-2086		2086-2087		2087-2088		2088-2089		2089-2090		2090-2091		2091-2092		2092-2093		2093-2094		2094-2095		2095-2096		2096-2097		2097-2098		2098-2099		2099-2100		2100-2101		2101-2102		2102-2103		2103-2104		2104-2105		2105-2106		2106-2107		2107-2108		2108-2109		2109-2110		2110-2111		2111-2112		2112-2113		2113-2114		2114-2115		2115-2116		2116-2117		2117-2118		2118-2119		2119-2120		2120-2121		2121-2122		2122-2123		2123-2124		2124-2125		2125-2126		2126-2127		2127-2128		2128-2129		2129-2130		2130-2131		2131-2132		2132-2133		2133-2134		2134-2135		2135-2136		2136-2137		2137-2138		2138-2139		2139-2140		2140-2141		2141-2142		2142-2143		2143-2144		2144-2145		2145-2146		2146-2147		2147-2148		2148-2149		2149-2150		2150-2151		2151-2152		2152-2153		2153-2154		2154-2155		2155-2156		2156-2157		2157-2158		2158-2159		2159-2160		2160-2161		2161-2162		2162-2163		2163-2164		2164-2165		2165-2166		2166-2167		2167-2168		2168-2169		2169-2170		2170-2171		2171-2172		2172-2173		2173-2174		2174-2175		2175-2176		2176-2177		2177-2178		2178-2179		2179-2180		2180-2181		2181-2182		2182-2183		2183-2184		2184-2185		2185-2186		2186-2187		2187-2188		2188-2189		2189-2190		2190-2191		2191-2192		2192-2193		2193-2194		2194-2195		2195-2196		2196-2197		2197-2198		2198-2199		2199-2200		2200-2201		2201-2202		2202-2203		2203-2204		2204-2205		2205-2206		2206-2207		2207-2208		2208-2209		2209-2210		2210-2211		2211-2212		2212-2213		2213-2214		2214-2215		2215-2216		2	
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24. The method of claim 20, wherein said sensor response is calculated using the equation $A_R = A_{\lambda 1} / A_{\lambda 2}$, where A_R is said sensor response, $A_{\lambda 1}$ is absorbance at $\lambda 1$ and $A_{\lambda 2}$ is absorbance at $\lambda 2$ and wherein $A_{\lambda 1}$ and $A_{\lambda 2}$ are determined by

$$A_{\lambda} = -\log \frac{I_{\lambda}}{I_{\lambda 0}}$$